MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR AND LAND PROTECTION DIVISION
ENVIRONMENTAL SERVICES PROGRAM
Standard Operating Procedures

SOP#: MDNR-WQMS-214   EFFECTIVE DATE: July 25, 2003

SOP TITLE: Quality Control Procedures for Data Processing

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SUMMARY OF REVISIONS: Added section 6.3 (GPS Data Reporting)

APPLICABILITY: This SOP is applicable to Water Quality Monitoring Section
                        personnel who generate numeric and/or narrative data
                        as a result of field surveys and/or laboratory work.

DISTRIBUTION: MoDNR Intranet
                        ESP SOP Coordinator

RECERTIFICATION RECORD:

Date Reviewed				
Initials				

1.0   SCOPE AND APPLICABILITY

Data are generated as a result of field and/or laboratory work. They can consist of numeric data, such as determining the dissolved oxygen content of a water sample, or narrative data, such as a description of the conditions of a stream during sampling. These data are used to make decisions regarding the state of the environment and in many cases can be used in environmental enforcement cases. Care must be taken in recording, storing and analysis to preserve representativeness. This SOP contains procedures which assure that errors introduced during data recording, entry and analysis are kept at a minimum. This SOP applies to Water Quality Monitoring Section (WQMS) personnel and to any data generated by the WQMS as a result of field or laboratory activities.

2.0   DEFINITIONS

    2.1   Locational Data – Numeric and narrative information describing the latitude and longitude of a site including the methods and accuracy of those methods that are used to collect the information.

    2.2   Data Entry – Transferring information from a hard copy to a computer database.

    2.3   Data Analysis – Applying a geographic, mathematical/statistical or other accepted analysis to existing information to produce additional information.

3.0   DATA GENERATION AND RECORDING

Data generation results from activities such as analyzing field parameters at a stream or analyzing invertebrates in the laboratory. These data must be recorded upon generation in logbooks, on data sheets or on some type of computer memory device, such as a computer's internal storage or on a floppy disk, for storage and later use.

    3.1   Field Notebooks. The recording of numeric and narrative data in field notebooks is covered in MDNR-FSS-004 *Field Documentation*.

    3.2   Task Specific Data Sheets/Logbooks. If specialized data sheets or logbooks have been developed, they should be used to record the data.

        3.2.1   Field Sheet and Chain-of-Custody Record. This sheet is used to record numeric and narrative data specific to sample collection documentation, transfer documentation and analysis requirements. This data sheet is covered in MDNR-FSS-002 *Field Sheet and Chain-of-Custody Record*.

        3.2.2   Quality Control Meter Logbooks. The procedures for entering data into these logbooks are covered in MDNR-WQMS-213 *Quality Control Procedures for Checking Water Quality Field Instruments*.

3.2.3   Stream Discharge Surveys. The data sheet for stream discharge surveys, and methods for collecting stream discharge data, can be found in MDNR-WQMS-113 *Flow Measurements in Open Channels.*

3.2.4   Locational Data. A locational data collection sheet must be used as a final step in recording locational data. This sheet may be completed in the field or upon return to the office. A blank electronic copy of the data sheet can be found on the program file server in Microsoft Word format. The most current copy can be obtained by contacting the DEQ GIS (Geographic Information System) Coordinator. Further information on collection of GPS data can be found in MDNR-FSS-220 *Procedures for Collecting GPS (Global Positioning System) Locational Data with the Lowrance GlobalMap 100 GPS Receiver*.

3.2.5   WQMS Laboratory Data.

3.2.5.1 Data generated in the Bio/Tox laboratory shall be recorded at the time of generation on approved data sheets (or in approved logbooks, as the project requires).

3.2.5.2 If changes need to be made to the recorded data, the erroneous data should be marked through with one solid line and the new data shall be written in the closest available space. The person correcting the data must then initial the changes near the correction.

3.2.6   CAS Laboratory Data. See MDNR-CAS-2020 *Data Review, Reduction and Transfer to LIMS*.

4.0   DATA ENTRY AND VERFICATION

Data generated by the WQMS are entered in a computer database or stored in the original hard copy format (notebook/logbook or data sheet). Data that are entered into a database must be entered and verified using the following procedures.

4.1   Data must be entered into a database from the original copy of the source (logbooks, data sheets, etc).

4.2   General Verification Procedures. The general procedures apply to all data. Data must be verified subsequent to being entered into a database. This may be done by any acceptable method that has been approved by the WQMS Section Chief. The method must be shown to reasonably preserve the quality of the data.

4.3   Established Verification Procedures. The Section has one established verification procedure which shall be applied at the discretion of the WQMS Section Chief.

This procedure applies to projects that require the handling of large amounts of data on a regular basis. It requires the review of each data point to assure it has been entered correctly. The steps are as follows:

4.3.1   Enter the data into the database.

4.3.2   Someone other than the person who entered the data must check the entered data against the original data sheet/logbook. Any errors should be noted on a separate piece of paper and attached to the original data sheet/logbook upon completion of the checking. Care must be taken not to make changes to the data at this time.

4.3.3   The person who entered the data must make any necessary changes to the data after it has been checked.

4.4   Chemical Analysis Data Verification. Prior to entering data from a MDNR *Results of Sample Analysis* report, the data must be reviewed by the sample collector to determine if it is consistent with the data recorded in their field notebook and/or on the Chain-of-Custody record. Any errors should be noted and reported back to the CAS so the data can be corrected and a *Modified Results of Sample Analysis* report can be issued. The data may then be entered from the *Modified Results of Sample Analysis* report into a WQMS database, as the project requires. Data entry verification may be done using any of the above approved methods.

5.0   DATA ANALYSIS

For specific projects data are analyzed by WQMS personnel to produce additional data. Examples are analysis of biocriteria sampling data to produce metrics or analysis of stream flow data to produce stream discharge results. These analyses can be conducted using conventional methods (i.e. by hand using a calculator) or through the assistance of software such as spreadsheets or computer algorithms.

5.1   General Considerations

5.1.1   All mathematical calculations must use the common rules of significant digits. When performing any arithmetic operation, it is important to remember that the result can never be more precise than the least precise measurement. When adding or subtracting, the result must be rounded off to the least precise value (i.e. the number with the least amount of decimal places). When multiplying or dividing, note the factor that has the least number of significant digits, then round the product or quotient to this number of digits.

5.1.2   When rounding numbers, look at the first digit beyond the rounding point. If this digit is less than 5, drop any digits beyond the rounding point. If this digit is greater than 5, drop any digits beyond the rounding point and increase the last digit by 1.

To prevent rounding bias when the digit is exactly five, first, drop any digits beyond the rounding point. If the last digit is now even, accept the number as it is. If the last digit is now odd, increase the last digit by one.

5.2   Conventional Data Analysis. Calculations must be done twice to verify the results. Although this requires twice the amount of time, it significantly reduces the chances of calculation errors, and helps the person avoid common errors in the future.

5.3   Software Assisted Data Analysis.

5.3.1   If a spreadsheet or computer algorithm is used to analyze data, it must first be approved by the Water Quality Monitoring Section Chief. It shall be tested and shown to work on a dataset that has been verified by hand or other suitable method.

5.3.2   Upon request the spreadsheet and/or algorithm shall be shown to produce the correct results on a known dataset.

5.3.3   If the spreadsheet or algorithm is updated, before it is used on real data it shall be shown to produce the correct results on a known dataset.

6.0   DATA REPORTING

Reports that are generated from data collected by the WQMS must be checked to assure that the information is consistent and accurate. This will be accomplished through the following procedures.

6.1   Chemical Analysis Results. These results are sent to the sample collector upon ESP Director approval. The reported information must be reviewed by the sample collector to determine if it is consistent with the data recorded in his/her field notebook and/or on the Chain-of-Custody record. Any errors should be noted and reported back to the CAS so the data can be corrected and a *Modified Results of Sample Analysis* report can be issued.

6.2   WQMS Reports. The WQMS generates reports for other agencies and in some cases reports results to the general public. Prior to finalization, the personnel generating the report shall check reported information against data sheets, logbooks, databases, etc., to ensure that the information matches what was observed during the data collection process.

6.3   GPS Data Reporting. GPS data shall be reported in units of degrees, minutes and seconds and using the datum WGS84. If the locational data does not meet these format requirements the data must be converted prior to reporting. This can be done using ArcGIS or CorpsCon software. In a report the latitude shall be stated first followed by the longitude in the following format:

Latitude: *dd° mm" ss.s'*, Longitude: *-dd° mm" ss.s'*

Where: *dd* = degrees
              mm = minutes
              ss.s = seconds

7.0   REFERENCES

MDNR-FSS-002 *Field Sheet and Chain-of-Custody Record*

MDNR-FSS-004 *Field Documentation*

MDNR-WQMS-113 *Flow Measurements in Open Channels*

MDNR-WQMS-213 *Quality Control Procedures for Checking Water Quality Field Instruments*

MDNR-FSS-220 *Procedures for Collecting GPS (Global Positioning System) Locational Data with the Lowrance GlobalMap 100 GPS Receiver*

MDNR-CAS-2020 *Data Review, Reduction and Transfer to LIMS*